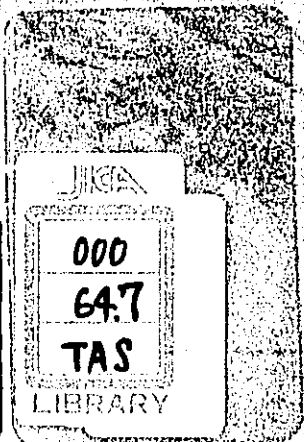


**VISUALIZATION TECHNIQUES
IN EDUCATIONAL PROGRAM**

NHK Central Training Institute

1979



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INTRODUCTION

NHK is always trying to develop program production techniques to improve the quality of programs. Program production techniques are diverse. In some cases improvements are made in accordance with increasing sophistication of hardware. In some cases improvements are made in the manner of program presentation. A combination of these results in vivid and attractive programs. Educational programs that need to present the contents interestingly and effectively are no exception.

This pamphlet titled "Study of Presentation Techniques" contains techniques that require no special equipment. These have been selected carefully from among numerous techniques used today largely in educational programs, since they can be used in other countries as well as in Japan.

Needless to say, of course, techniques that can possibly be applied to programs other than educational programs are also included.

While the study of presentation techniques is undertaken as an integral part of the training course, complete effect is only obtained when it is carried out conjunction with practice in the studios. However, it is possible to grasp the concept to a certain extent by merely reading the pamphlet.

We will consider our efforts worth while if you should find new TV techniques as a result of this pamphlet and apply them effectively to broadcasting program production.

CONTENTS

		Page
1.	Caption Techniques	1
	a. Pull Technique	1
	b. Roller Caption Technique	2
	c. Magnet Ferrite Technique	4
2.	Handicraft Technique.	8
	a. Silhouette	9
	b. Semi-silhouette	11
	c. Animated Paper Insertion	14
3.	Montage Technique, etc.	16
	a. Chroma-key	16
	b. B.G. Color System.	22
	c. Special Studio Technique	31
4.	Animation Techniques	33
	a. Brushing-in.	33
	b. Cutting-in	34
	c. River, Train and Smoke	35
	d. Clock	36
	e. Movement of Character	36
	f. Variations in Facial Expression	36
	g. Building Blocks.	37
	h. Clay Modeling.	38
5.	Program Production Techniques.	39
	- Mini Production - Program	
	a. Scientific Program Sound Vibration	39
	b. Children Program Urashima Taro	42
	c. Mathematics Program. Set Operations	40
	d. English Program Comparison	43

1. Caption Techniques

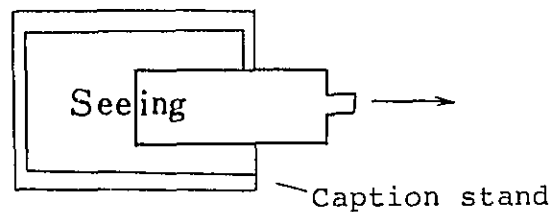
Caption as used here is a generic term applied to cards, such as subtitles, graphics, photos, drawings and cartoons. It is a technique used widely in educational programs, and entails from moving the captions and opaques. It is simple but it gives an effect close to animation. In fact, it is better than film animation in that the speed can be changed according to the speaking tempo of the speaker or narrator in the studio.

a. Pull Caption

At NHK pull-out captions are put on the caption stand in the studio, and the floor manager or assistant manager normally operates them according to the instructions of the program director or performer.

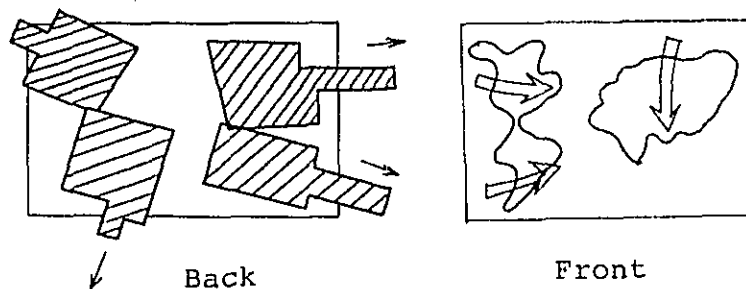
1) Emphasis effect arising from pulling out

The written word have a striking visual effect if they appear gradually. As breaks are conspicuous, superimposed captions are normally used for written captions.



Since the lines of a map or some statistics appear gradually during the pull-out operations, the change can be grasped temporarily.

This technique cannot be applied to any caption with complex lines or to any curve with too large a curvature.

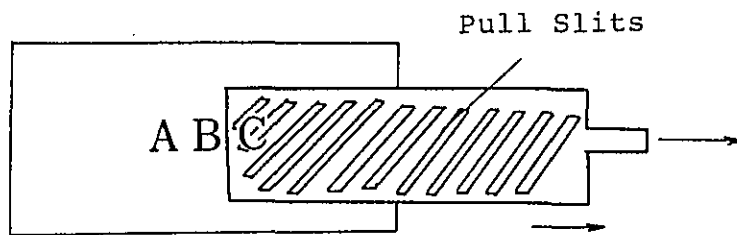


It is possible to improve the effect by changing some specific portion in the scene.

Example: Presenting different answers to the same question in pictorial form in a language lesson program.
 What is it? Desk, chair, globe etc.
 What do you see between your home and the station?

2) Decorative effect of pull-out

Numerous slits are made either vertically or slantingly among the stripes used in the pull-out technique, and a brilliant effect is given to the characters by the movement of the slits.



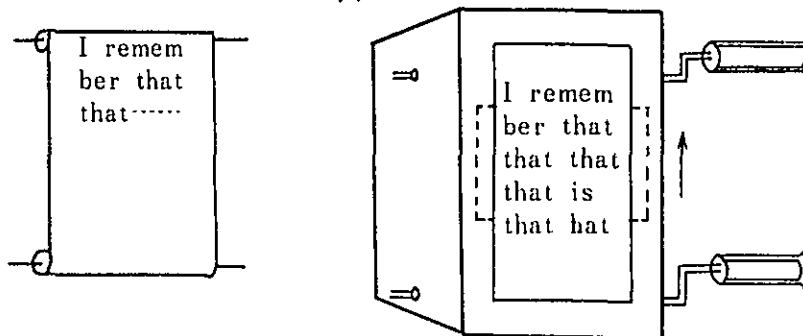
b. Roller Caption Technique

1) Character effect

A long sheet of paper with words written on it is moved horizontally when the words are written from top to bottom and vertically when the words are written in horizontal lines. This technique is used to display credits or the names of the cast. It is also used at the beginning or the end of a program to emphasize the aim of presentation.

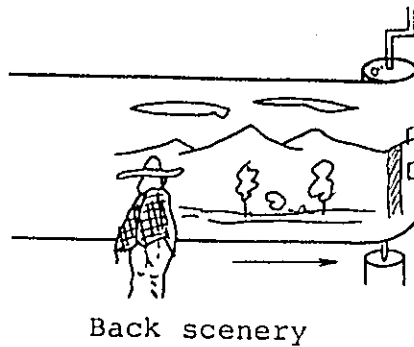
In programs like language lessons, too, it is used to present written information in parallel with talks or recitations by the performers. Written information can be matched with the progress of studio performance since the speed of movement is adjustable. In short, effects not available from animation films, such as repeated reading, skipping of lines in reading, and change of reading speed, can be obtained.

☆ F.S.S. ... Flying Spot Scanner (special effect machine in sub-control room by electronic circuitry.)

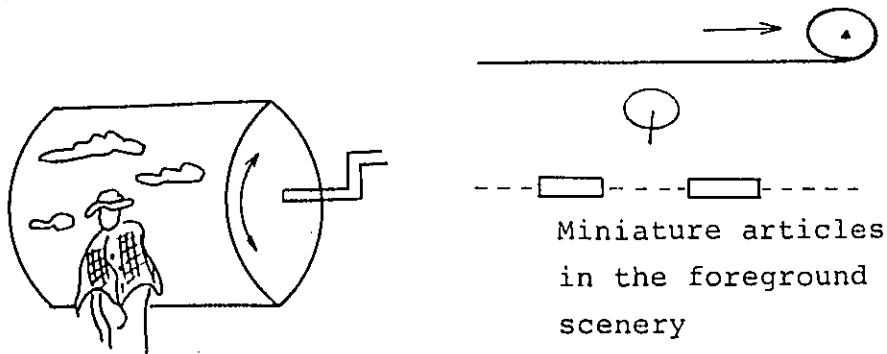


2) Setting Effect of Roller Caption

More accurately, it should be termed roller graphic or roller cartoon technique. Scenes, such as streets with houses and shops and the sky, are drawn on a long roll of paper and dolls, miniature automobiles and so forth are placed in front of the scenes. When the background scenes are moved, you can achieve an effect as if the foreground scenes are moving. In this case, arrangement of miniature articles in front of the automobiles, human figures, animals and so forth that appear to be moving give a greater three-dimensional effect.



It should be noted that the ratio of the speed of motion against the background is highly important.



c.g. 8 ROLLER CAPTION (1) LETTERS

CAMERA	VISION	NARRATION
CI	BS	This is the story of how modern men learned to read the picture writing of the ancient Egyptians. Their way of writing had been forgotten thousands of years ago.
CII	Roller caption	Napoleon, (a famous general who became the emperor of France) once went with



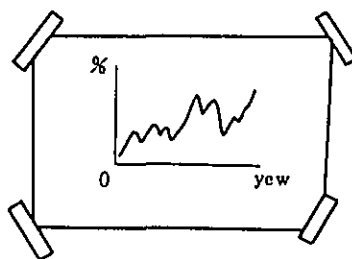
(pointing to the caption-letters of hieroglyph-)

- CII BS Here is a word from the stone:
 And here is what it means: CLEOPATRA. Each sign was the name
 of a thing which contained a certain letter.
 This is the same as drawing a cat, an apple, and a ring to make the
 word car.

c. Magnet Ferrite Technique

1) Magnet stripes

Using small plate-like or button-like magnets a large and thin sheet of paper containing statistics or a map can easily be posted on an iron blackboard. The sheet can also be changed for another without trouble. This is effective for providing supplementary comments for talk programs.



In programs presenting lessons in language or mathematics, letters or figures to be written on the blackboard are written on cards and magnet ferrites are pasted on to the backs of the cards. Posting of these cards on the blackboard saves the time it usually takes the instructor to write them on the blackboard. This system also allows display of accurate and precise letters and pictures on the blackboard.

$$(\sqrt{2})^2 = 2$$

Front

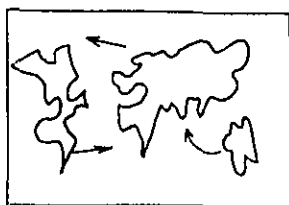


back

However, improper use of this system may lead to too speedy progress of program, depriving the viewers of time to digest the program contents.

Pictures and diagrams drawn on thick paper are clipped out and magnet ferrites are pasted on the backs. The pictures can easily be moved to coincide with the performer's talk.

This system features moving of the pictures by the performer himself so that the contents of his talk may be made more easily understandable.

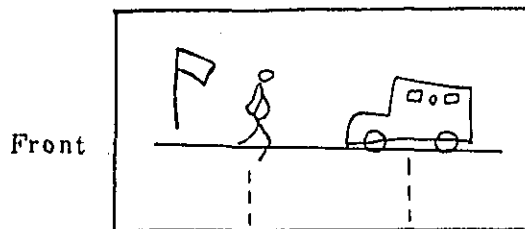


Front



back

Movement of Continent



Front



back

magnet Ferrite

e.g. 1 CAPTION TECHNIQUE - USE OF MAGNETIC PIECES (1) THE THEORY OF CONTINENTAL DRIFT

CAMERA	VISION	NARRATION
	opaque card MOVEMENT OF CONTINENT	
C I	WS	For many centuries the continents had been thought immovable. About half a century ago, however, an imaginative and adventurous geologist noticed something curious while gazing at a terrestrial globe.
C II	LS (in front of a blackboard)	The geologist, Alfred Wegener, noticed the fact that the eastern side of North and South America could be fitted into the western coast of Europe and Africa. (pointing to) With this observation as a hint, Wegener developed the theory of continental drift in 1915.
C I	captions	America moved this way ... and Australia this ... The theory was found convenient for explaining a number of mysteries in geology and paleontology. The theory postulated that when the earth was in a more primitive state, it had a continuous land mass.
O A	opaque card drift of continent	
C I	captions	For millions of years the land mass drifted over the heavier layers of the earth's crust like a ship moving on the surface of the water, and the continents, oceans and island were eventually formed into the shapes they now have.
C II	WS	The theory of continental drift is widely accepted in the academic world today.

e.g. II CAPTION TECHNIQUE - USE OF MAGNETIC PIECES (II) EQUATION ON A BALANCE

CAMERA	VISION	NARRATION
	opaque card EQUATION ON A BALANCE	
C I	WS (in front of a blackboard)	When we deal with an equation in mathematics, the most important thing to remember is that the right and left sides of the equation have to be always balanced and equal. Hence the name "equation". Today we shall study how to deal with the equation $ax+b=c$, using the picture of a balance.
C II	LS (with the blackboard)	The dwarfs in this picture indicate numerical units. The question is how to find out X.
C I	Up Shot (caption)	Since 'c' is on the right side, you can see how many dwarfs are on the right side. Some of the dwarfs are on the left side are hidden in the can or box.
C II	$3x+2=11$	So we are unable to count them, but we can assume that there should be 12 dwarfs on the left side because both sides are balanced. To find out how many dwarfs are hidden in the can, it's necessary to remove the number of dwarfs already known from both sides. (remove the dwarfs on the right and left sides)
C II	$3x=11-2$	The important thing is that the same number of dwarfs has to be removed from each side. Unless this is done, the balance will tip either way.
C II	$3x=9$	Now, $3x$ s are equal to 9 dwarfs on the right side. The question is the number of dwarfs per x.
C II	$x=3$	To find this out, you can remove the same number, or half, one third from both sides. Thus, the number in x is shown on the right side.

CAMERA	VISION	NARRATION
		Yes, 3 dwarfs No matter how well the dwarfs may hide themselves in the can, we can soon bring them to light. The equation $ax+b=c$ may be likened to a detective who can tell exactly how many dwarfs are in the can.
C I		
C II	LS (with the blackboard)	Now I'll do it again but this time without explanation. Why don't you play detective in your mind and find out the number of dwarfs?
C I	Up Shot	
C II	WS opaque card EQUATION ON A BALANCE	Please remember this picture when you deal with equations in the future. The dwarf principle applies likewise to such advanced equations as $ax+bx=c$.

2. Handicraft Technique

The handicraft technique consists mainly of using sheets of paper to achieve a grateful screen effect. The crux of this technique is the use of cheaply available paper as material. What is important in this technique is the effective application of new ideas to the programs.

Necessary implements

Colored sheet of cardboard, tracing paper, various kinds of poster color, brushes, ruler, stapler, cutter, scissors, bonding agent, adhesive tape, slender wooden material and rubber bands.

Examples of handicraft application

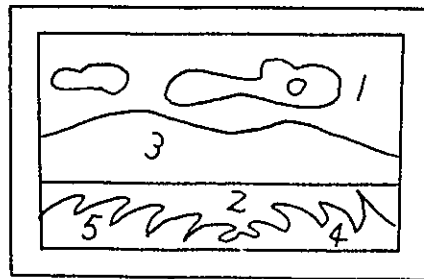
Torebi foundation:	Visual expression of an Italian story.
Mr. Fuji in folkstory:	Expression of old customs and manners of Japan in music.
Mother and child in animated paper program:	Concurrent use of the above two methods.
Village children in music program:	Making little children understand music.

c.g. a. Silhouette

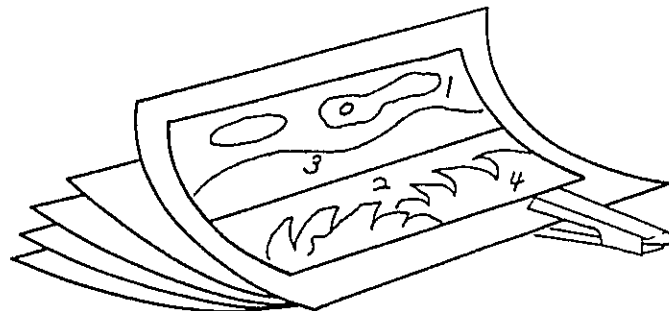
Pile up several sheets of transparent paper, one of top of the other, to produce a shade of color as well as sharp knife-cut lines, thereby producing a visionary effect that is entirely different from the brush-drawn picture.

Process of making:

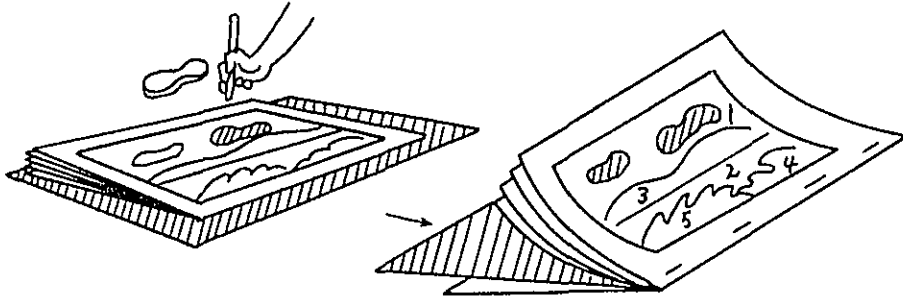
1. Draw a picture on a opaque paper (flock paper).
Then draw a profile with a pointed pen, to determine the shade of color when the stage of the color shade is to be determined at the same-time, determining the number of paper-sheet to be piled. Each area of the surface drawing is to be marked with a number in the order of brightness (in case of 5-ply) - such as 0, 1, 2, 3, 4, 5.



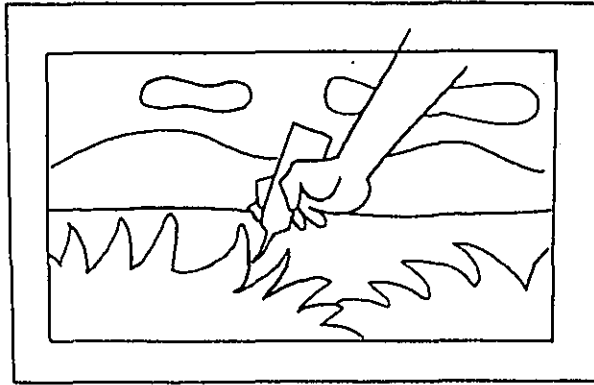
2. Pile up 4 sheets of semi-transparent paper (tracing paper or a carbonless duplicating paper) undernet the rough sketch drain on a flock paper to make a total of 5 sheets, whose bottom parts are fastened by a stapler.



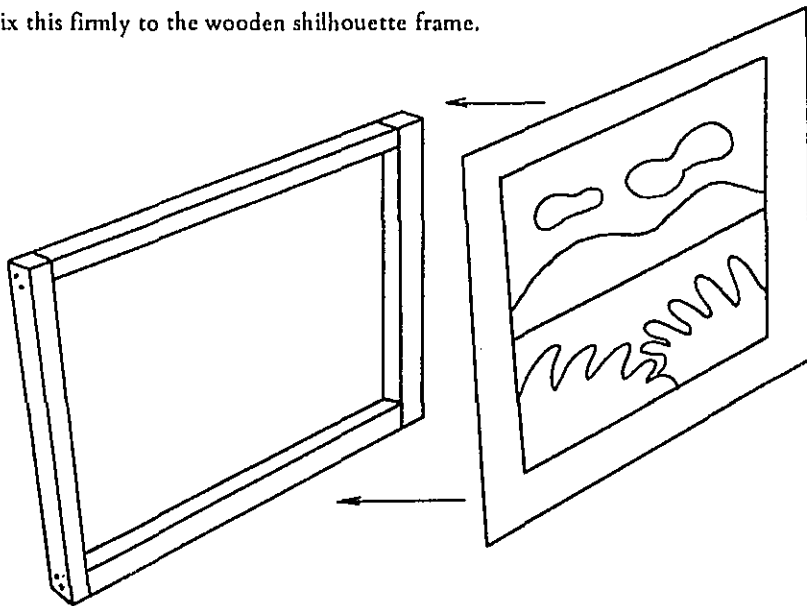
3. Then go on to the cutting out process. Firstly, out the 0-marked portion after placing a thick ground paper under the 5-ply sheet. Insert the ground paper between each of the 4 sheets placed on top the bottom sheet. Then clip out the 1-mark portion. In the same way, continue inserting the ground paper between each sheet one by one, and continue clipping until the 4-marked portion is clipped out.



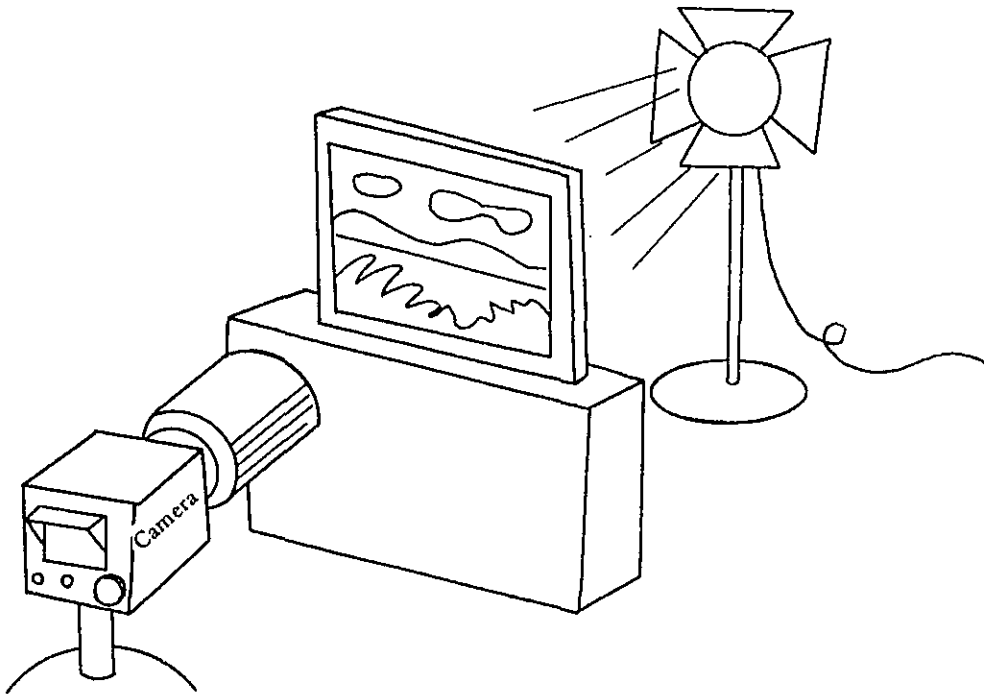
4. Fix the broken-up portion with adhesives.



5. Fix this firmly to the wooden silhouette frame.



6. In making a colored silhouette, paste the cellophane on to the reverse side, by exposing it to the light.

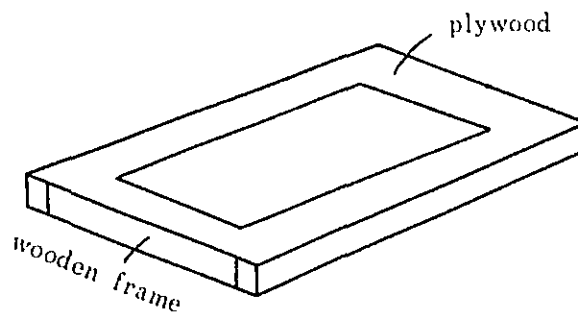


c.g. b. Semi-Silhouette

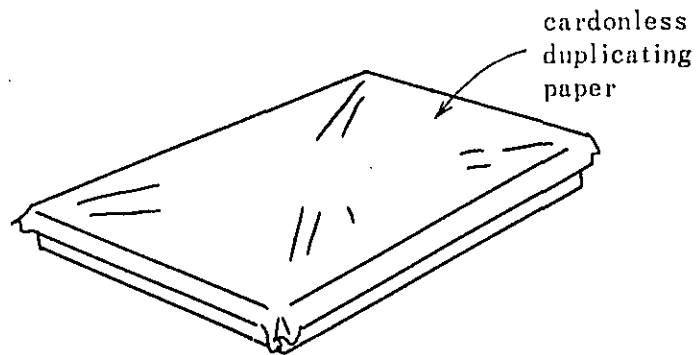
This technique is employed to produce animation effect, when one wants to point out some particular object in the picture or drawings. For this purpose, a transparent paper is used.

Process of Making:

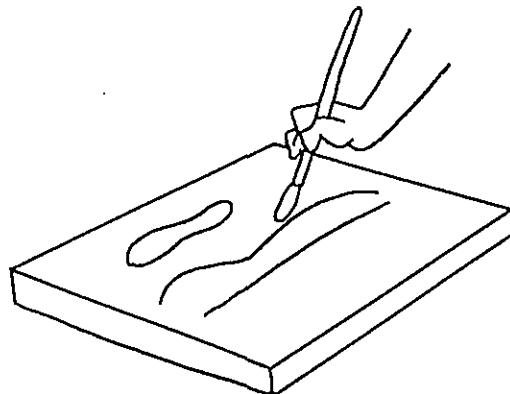
1. Prepare a wooden frame to which a piece of plywood is nailed whose safety part is cut out.



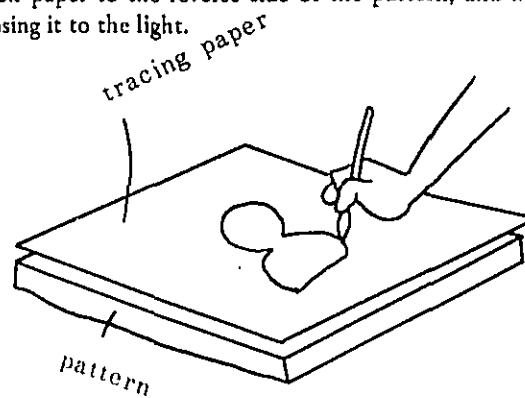
2. Then cover the whole frame with a carbonless duplicating paper, so as to prevent halation.



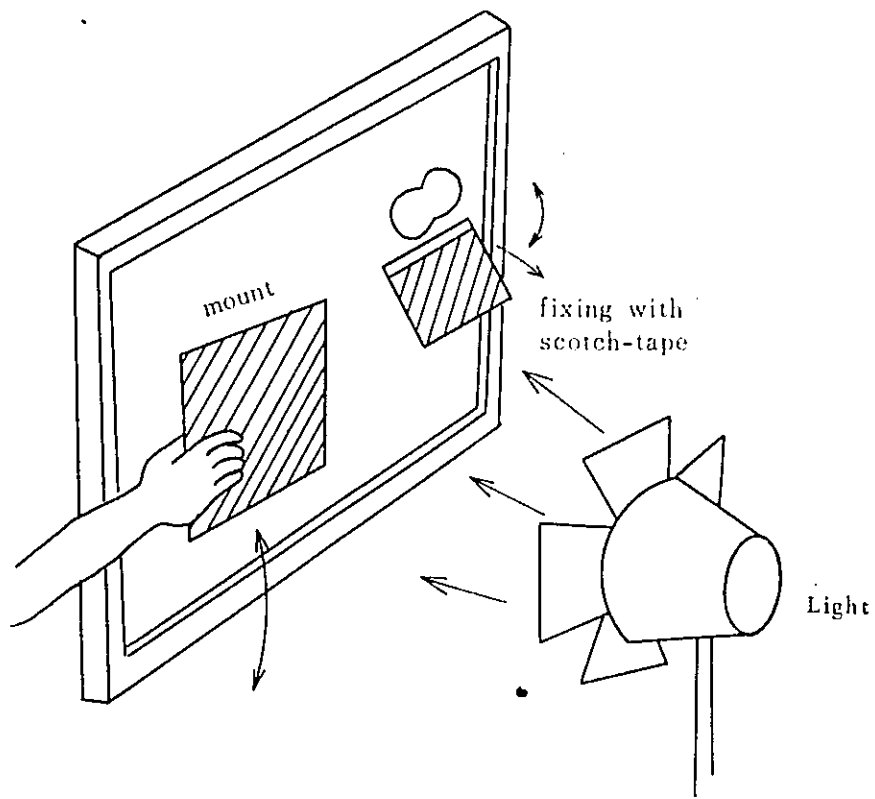
3. When the pattern is made, draw a picture on the surface. The coloring should be done in water color so that the light can pass through the silhouetted portion.



4. Then apply a tracing paper to the surface-drawing to trace the silhouetted portion. The silhouetted portion thus traced is to be cut out using a black flock paper as an underlay. Then apply the flock paper to the reverse side of the pattern, and move it to the right position, while exposing it to the light.



5. When erasing the silhouette, use a black cardboard holding it by hand or fixing it to the pattern in the same manner as a door.

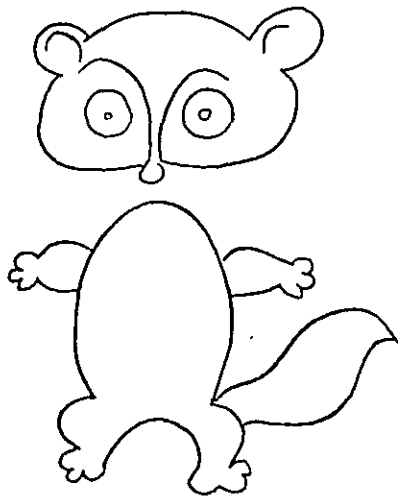


e.g. c. **Animated Paper Insert**

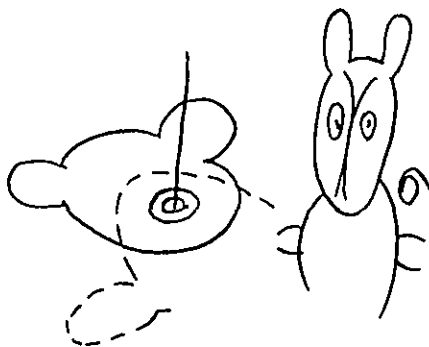
It is a simple device to produce a moving picture. It is used principally for marking time behind the song or for making the picture walk in the drama scene.

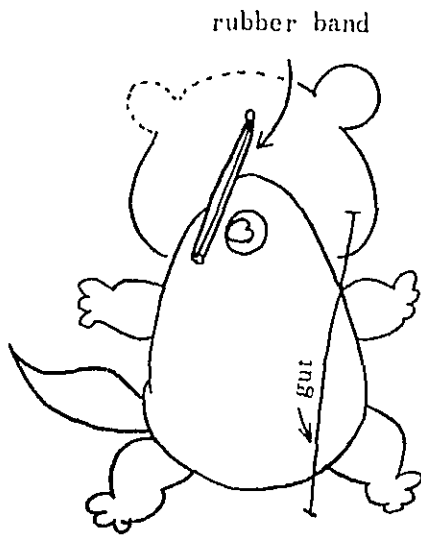
Process of making:

1. Make the movable portion separately.

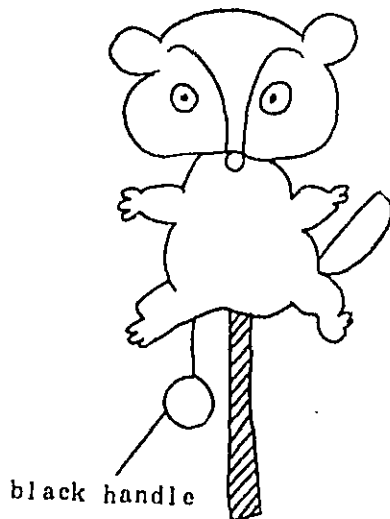


2. Each portion thus made is connected by wire, in such a manner that the front portion is adhered to the one end of the wire, whereas the rear portion runs through the wire with the other end of the wire pinned up.





3. The two portions are fastened by a rubber band which is pulled to one moving direction.
4. Use a fishing gut to connect two portions at the point where the reverse motion may be caused. Fix a knob at a place where the fishing gut juts out of the paper insert.
5. Fix a black handle at the rear.



3. Montage Electronic Technique, etc.

a. Chroma Key

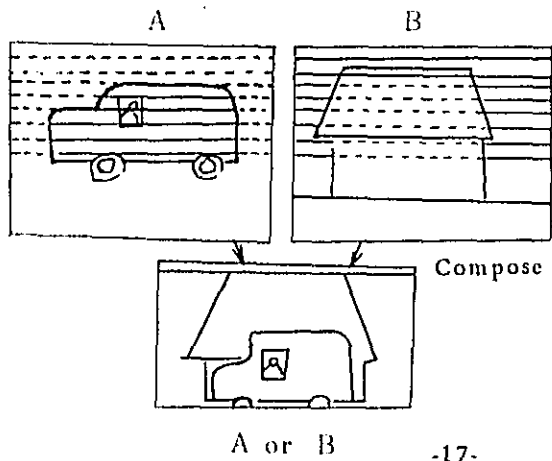
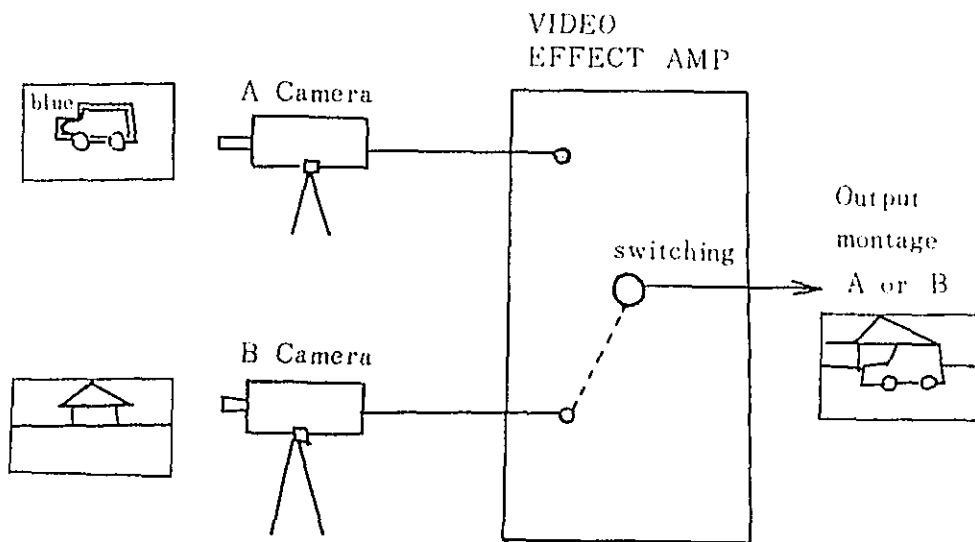
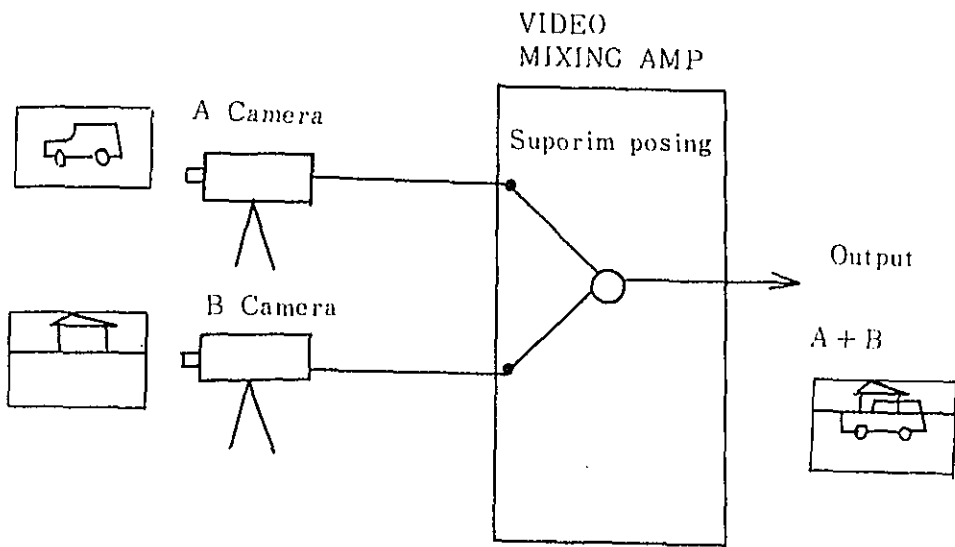
In this system, a subject is first cut out by electronic circuitry with the help of the difference of colors between the subject and the background, and the subject thus cut out is set in another video by montage technique. This technique has been called "chroma-key" by RCA. A moving figure, taken with a color TV camera or the like, can be inserted into a video taken with another camera. Caution must be taken, however, that the figure to be cut out and its background do not include the same color type. Usually blue is used for the background since this is a color not included in the human skin, and the figure wears a costume that does not contain blue or the blue color type.

Using this technique, we can insert a person standing in a studio into another video of, say, a real street scene. Or, we can make a person walk through a drawing of a street scene.

This technique can be used in various ways in news, educational, entertainment and other categories of programs. If used excessively, however, the technique may cause confusion on the screen.

If there is a blue area in a costume, that area becomes transparent. Using this principle, we can make a person invisible on the screen by having him take off his coat.

This technique is called "chroma-key" by NHK "video scene" by CBS, "video keying" by other U.S. broadcasters and "magic scene" by Japanese commercial broadcasting companies.



Practice CHROMA-KEY (I) -A FIGURE IN A SKETCH-

CAMERA	VISION	SOUND NARRATION AUDIO
	opaque card STANDING IN A SKETCH	
C I	WS with caption	Do you know "Alice In Wonderland", famous tale? (ad lib) Please look at this ancient scene. I'm drawing this arch like this. This is not the real world as you know, but for me a real wonderland
C II	caption; the Arch of the Great Constantine (after drawing it a little bit, pull one's finger out) Frame In look or turn around point to the Arch of the Great Constantine	(change from one microphone to another) SE F/I I am now appearing in my sketch like Alice in wonderland (ad lib) That building is the famous arch of the Great Constantine, which was (ad lib) So long from the wonderful scene.
C I	WS with caption	(change the microphone again) (ad lib) So long again!
	opaque card STANDING IN A SKETCH END	

CHROME-KEY (3) CHROMA-SCREEN BEHIND THE PERFORMER

CAMERA	VISION	NARRATION
C I	LS our performer in front of the chroma-screen Z/U to screen	<i>Good afternoon everybody!</i> Today's topic is about "industrial develop- ment and international trade
Film	field--factory--chimney-- port--ship--	This town is
C I	LS the performer sitting in front of chroma-screen-	As you saw, (ad lib) Good-bye and see you again.
	opaque card How to use "chroma-screen" END	

CHROMA-KEY (4) CHANGEABLE CHROMA-KEY

CAMERA	VISION	NARRATION	AUDIO
	opaque card CHANGEABLE CHROMA- KEY		
C I	WS with a fan in one's hand (open the fan, turn it round)	I'll show you some Japanese sceneries in this fan. (ad lib) (film start)	
C II Film	FS of the fan and scenes of film (composite)		Music (back ground)
C I	WS with the fan (turn round, close it)	How about our magic scene? I hope you'll farther (ad lib) This is the end of the 'fan and fun'. Thank you.	

CHROMA-KEY (4) CHANGEABLE CHROMA-KEY

CAMERA	VISION	NARRATION	AUDIO
	opaque card CHANGEABLE CHROMA-KEY END CHROMA-KEY (5)		A DOLL IN THE AIR
C I	a doll on a paper-box. (paint the box blue, then disappear the box-stand)		

CHROMA-KEY (5) AS A SCENERY IN THE STUDIO

CAMERA	VISION	NARRATION
	opaque card CHROMA-SCENERY	
C II	BS interviewer	Fine arts always fascinate us, (ad lib) So today I'll interview
C I	2S interviewer and interviewee	How do you do? Mr (or Mis) It's said that ancient arts are (ad lib)
C II	BS interviewer	
C I	BS interviewee	
C II	2S	Thank you so many times, I appreciated those fine arts painted and made of wood in ancient days.
	opaque card CHROMA-SCENERY END	
	CHROMA-KEY (7)	CHROMA-POINTER
Film	"eye" pointing to a pupil handling the chroma-pointer	

Application 1: Chroma-pointer

In this technique, an instructor explaining with a pointer a film or VTR inserted in the program is first recorded on camera, and then the position is marked with the pointer on another screen.

This is a sort of video montage done with the help of the chroma-key principle. Any monochrome screen can be used. Using this technique, an instructor can point exactly to any position to which he wishes to draw the audience's attention.

Application 2: Synchro-zoom System

In program production, a chroma-key montaged video sometimes has to be zoomed simultaneously with two cameras. Hitherto, this was usually done by two cameramen coordinating their movements with each other.

In the synchro-zoom system, a perfectly synchronized zooming is possible with the help of the servo-lenses of two cameras which are controlled by one of those cameras. The system also has a function for reverse, simultaneous zooming.

By operating a switch, each camera can be used independently.

b. BG Color System

This is a system capable of changing caption colors with electronic circuitry. When combined with the colors of superimposed letters or the background of cutout captions etc., it has a wide range of uses. By changing the hue and brightness, we can produce any color desired. The four-pre-set colors can be changed at will, with the touch of a button.

Techniques of Visualization by Lighting

Lighting plays a big role for TV images, which are said to be arts of light and shadow. Light is necessary to make things visible. It stimulates the originality of us TV men to produce images of light in television by utilizing this peculiar fact, and when we succeed in this attempt, we feel a great joy.

Pursuit of beauty, which may be called the predetined objective of producers, requires culture and artistic abilities. Television, an all-around art, needs the unity and cooperation of the staff from producers down to performers and all stage hands including technicians and artists, to achieve its objectives. Especially the "techniques of visualization by lighting" require positive cooperation by the light staff centering on the light directors. It should be noted that all TV work cannot be done by a single person.

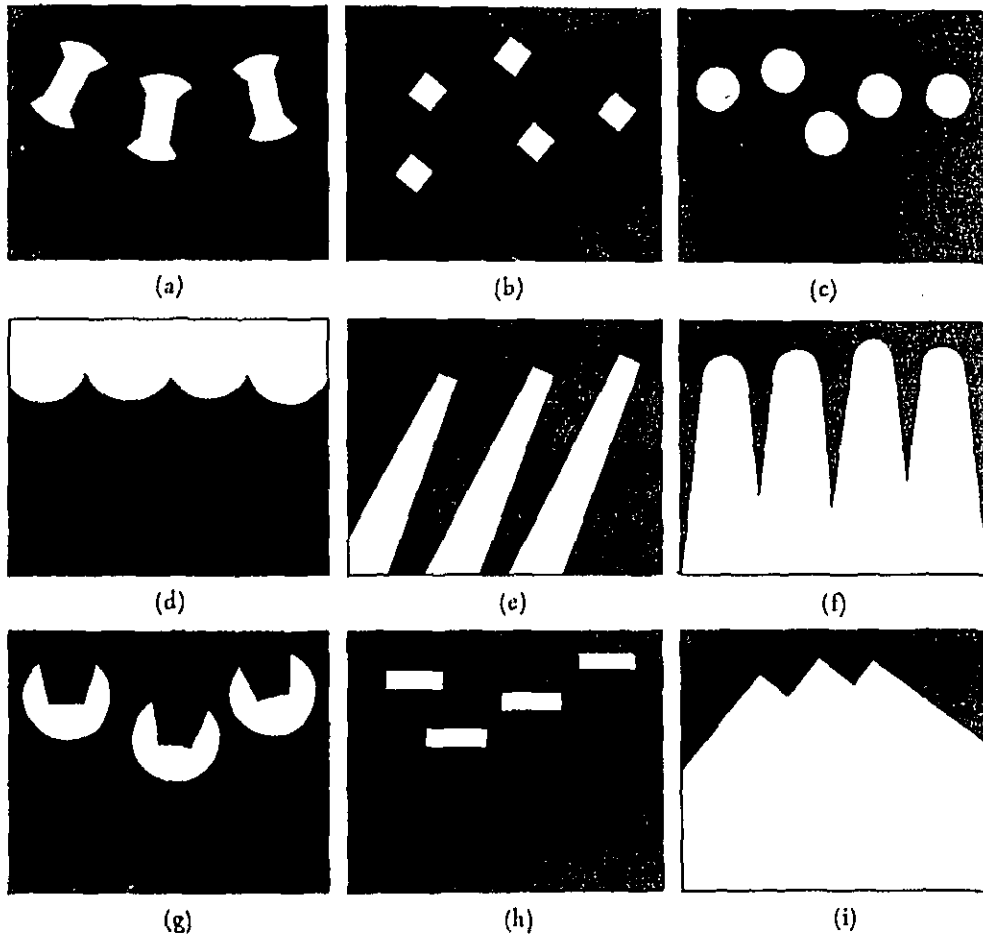
The techniques of visualization by lighting can be divided broadly into the following three categories.

- [A] Methods (techniques) of producing light effect by utilizing shadow,
- [B] Methods utilizing special "effect apparatuses,"
- [C] Methods utilizing reflected light.

[A] One method of this category uses focus or barndoor (two or four blades in front of (the Fresnel lens of) the solar spot; the light is shielded by the use of the vertical and horizontal blades) with the direct use of a lighting apparatus. Another method is to produce an effect by placing an object in front of a lighting apparatus.

1) Tough light method

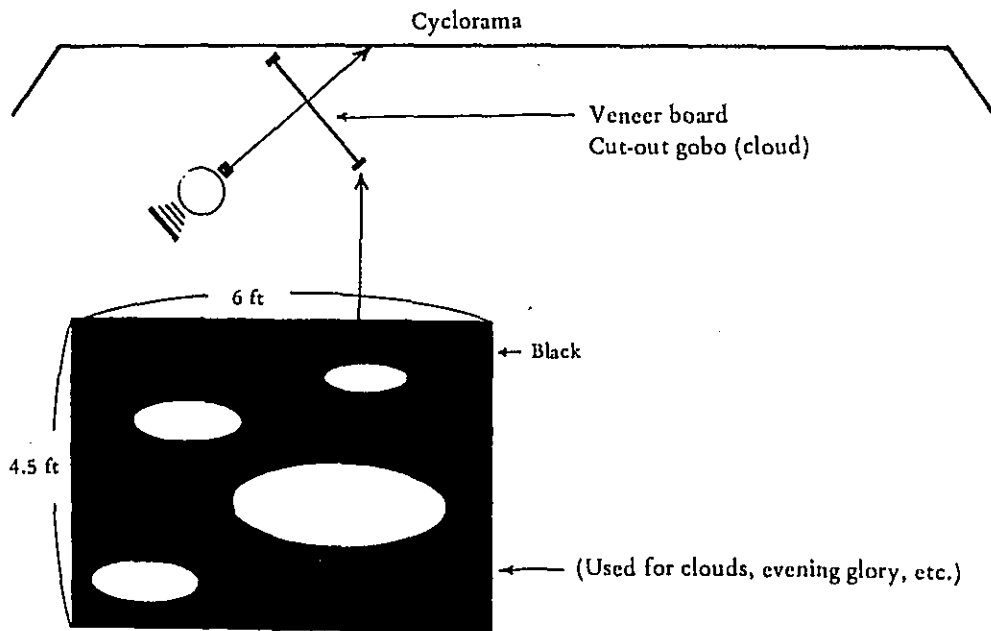
This method produces shadow by projecting various patterns on the cyclorama and the studio floor with a lighting apparatus.



Various touch lights by altering barn doors

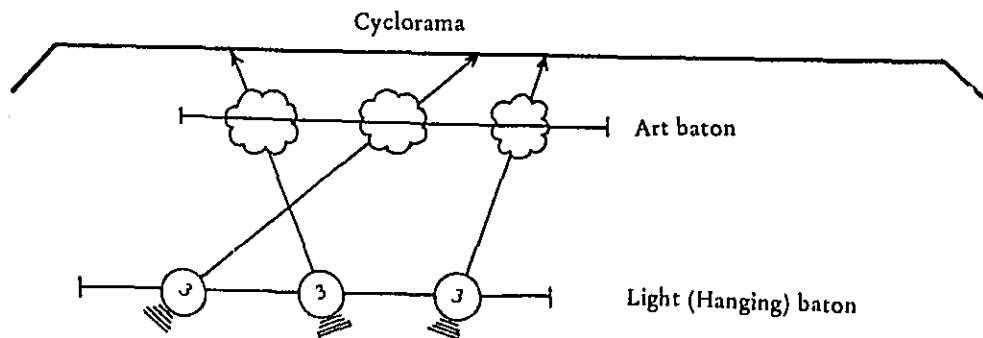
2) Gobo method

In this method, a veneer board (3 x 3 ft), (4.5 x 6 ft), (6 x 6 ft) and (6 x 9 ft), from which a shape is cut out, is placed in front of a large 3 kW or 5 kW lighting apparatus, to project the shadow of the cut-out shape on the cyclorama or the floor.

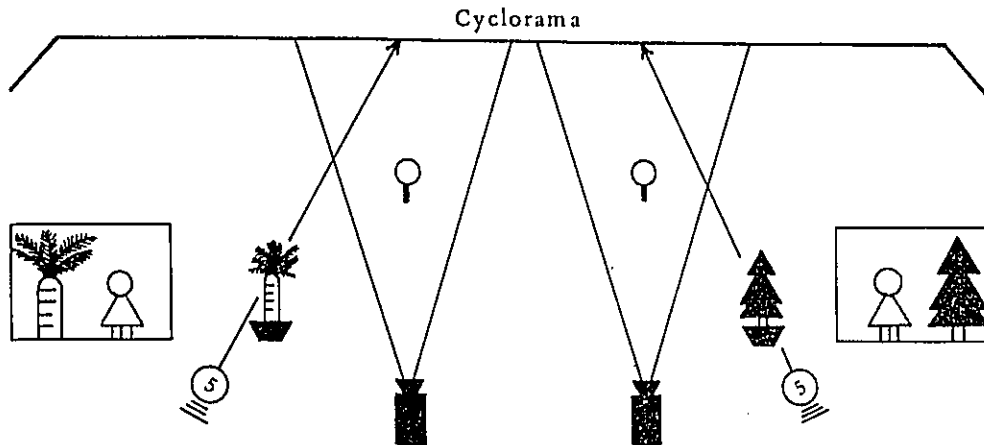


The technique of pasting on the barn door a shape cut out of paper is also used frequently as a simple gobo.

Tree branches and leaves are also hung from the art baton to produce their shadows on the cyclorama.

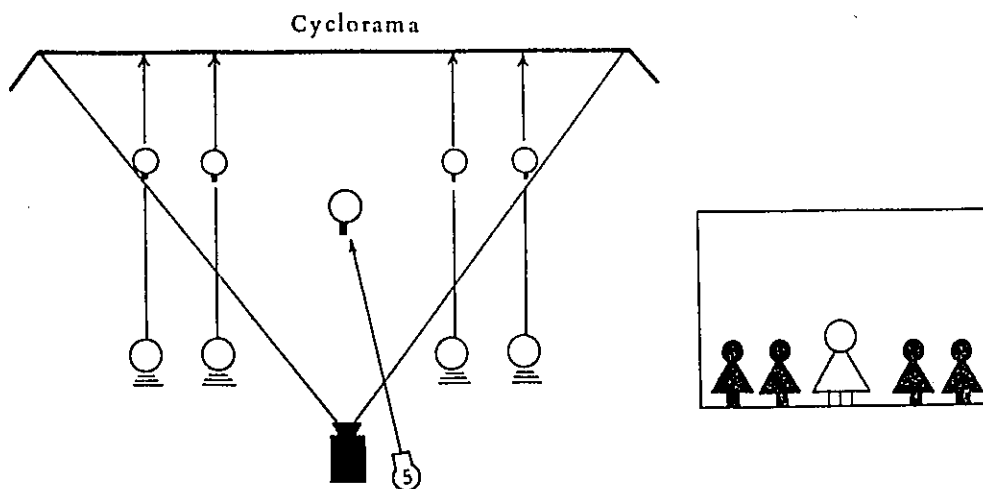


Shapes of a potted plant and a phoenix tree are often used for gobo.



3) Method of casting the shadow of the subject on the cyclorama.

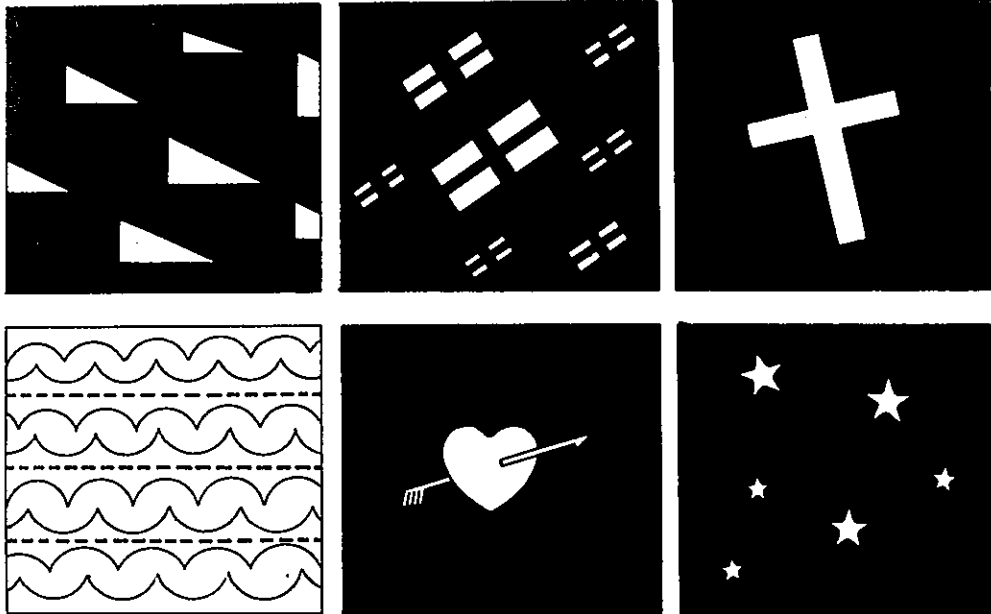
By casting on the background a big shadow of a singer or a dancer, his or her movements are magnified. In this case, a pin or solar spot light is used besides the light on the subject, to produce a shadow. The spot light had better be projected from a low position to produce a shadow from end to end of the cyclorama. Because this technique sometimes dazzles the performer, full care must be taken.



[B] This category utilizing special "effect apparatuses" has a large variety as follows:

1) Effect spot method

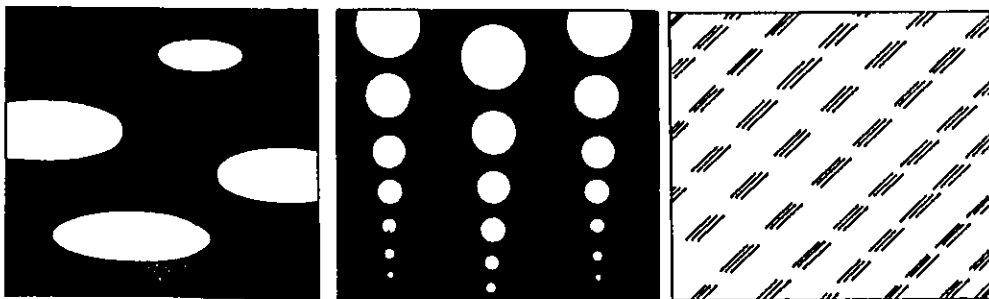
Various patterns engraved (cut out) on aluminum foil are projected on the cyclorama with the use of an effect spot light or a wide-angle lens.



2) Effect machine method

This technique is similar to the effect spot method, but the machine part turns and provides moving patterns.

The apparatus of this technique consists of the light source part, the machine part and the end lens. The patterns put in the machine part turn. Endless film is generally used in the machine plant. Recently a round disc is used in many cases.



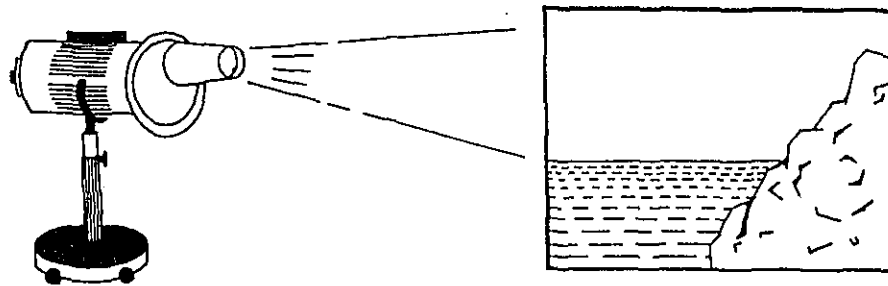
(Drifting clouds)

(Drops of water going up)

(Flowing beams of light)

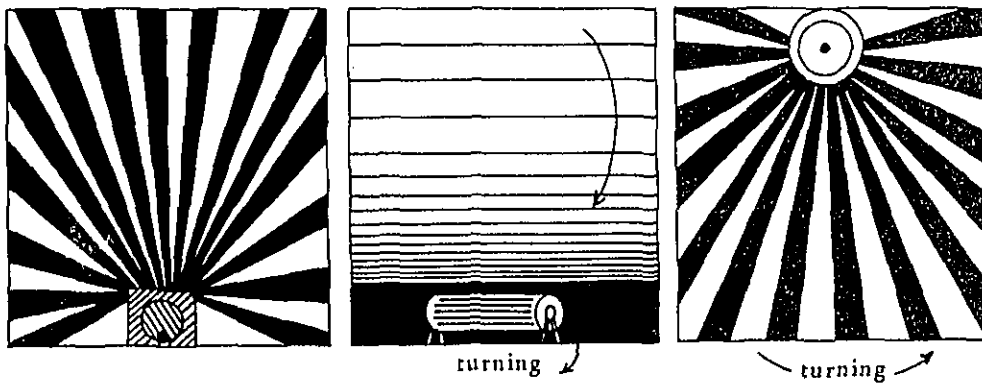
3) Ripple machine method

The lighting apparatus in this method is to produce a water surface effect in the screen process and on the cyclorama. The machine part has three plates, from which wave patterns are cut out, or three plates on which many pieces of iron wire are stuck. By moving these plates up and down, moving ripples are produced. In this case, we can get a beautiful and fantastic picture by properly gradating the projected images.



4) Rising sun machine method

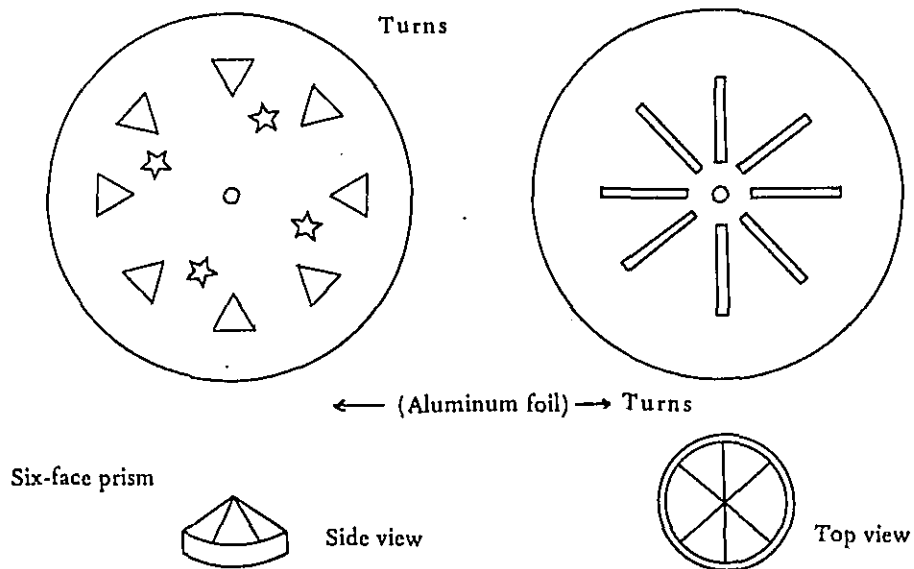
An electric bulb is placed in a cylinder, which is about one foot across and has a cut-out striped pattern, to project rising sun-like beams. It is also possible to project moving patterns by turning the cylinder.



The rising sun machine is either placed in the studio setting or hung from the baton. The light is projected from this machine on the floor or the cyclorama. If the striped pattern is projected at a right angle to the cyclorama, rising sun-like beams will appear, and if the striped pattern is projected parallel with the cyclorama, a lateral striped pattern will move up and down.

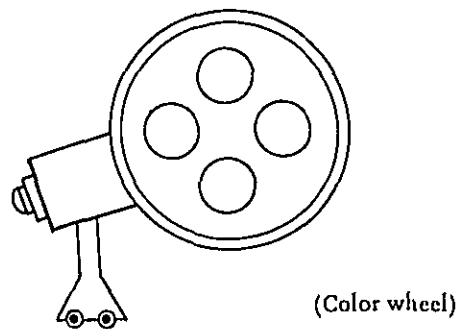
5) Overhead projector method

Recently, the technique of projecting images by using an overhead projector is often employed. Aluminum foil with a cut-out pattern is placed upon the overhead projector when projecting the light from it. NHK has developed a system which turns in opposite directions two sheets of aluminum foil placed one upon the other. This system makes it possible to produce complex geometrical patterns. A multiface (5-6 faces) prism is used to produce more complex patterns.



6) Color wheel method

The color wheel used in theaters for light effect is often used for television, too. A wheel of four to five colors (Cf. illustration) is turned to produce variegated colors. The color wheel is effective to produce a gay atmosphere in a music programs.



7) Strobe light method

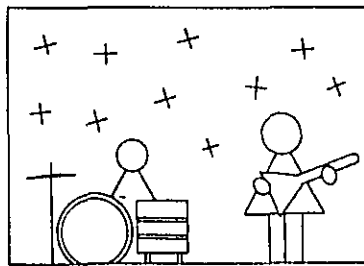
Continuous on-and-off switching of the strobo light used for photographing is effective for television, too. Because of the strobo effect, a person moving sideways looks as if jumping. This technique has a wide range of uses.

8) Baby spot method

A small box-shaped spotlight, the simplest of its kind, is placed on the stage, with its face turned toward the camera. It is turned on and off while a rock band or anything of the sort is performing, to produce a good effect by sending light directly to the camera. *Cross light effect is also available by using cross filter while baby spotlight is being used.

9) Others

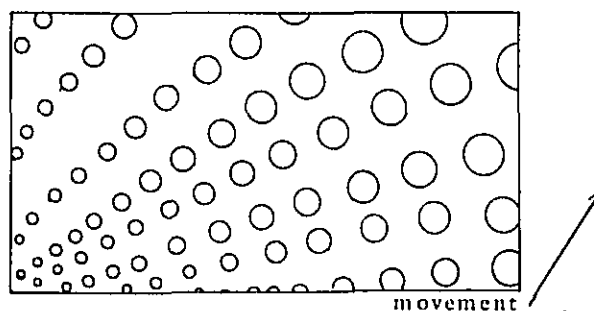
Besides, there is a technique using laser beams. (This technique, now being studied at the NHK Technical Research Laboratories,) will probably be put to practical use soon.



[C] In addition to direct techniques using lighting apparatuses, we use reflected light by means of a mirror ball to achieve a good light effect.

1) A mirror ball is covered with very small mirrors.

The shape is globular, but there is an elliptical one. Mirror balls are turned by motor. When the spotlight is applied on a mirror ball, many reflected images appear on the cyclorama and produce a gay, colorful effect.



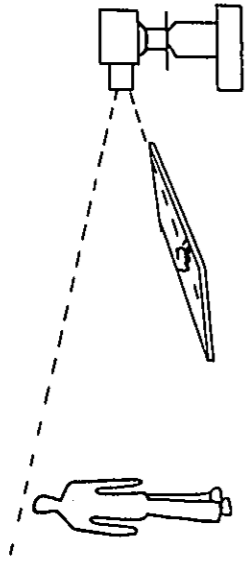
2) *Effect by mirror tate*

A rhythmical effect is produced by applying the light on an acryl mirror or any other pliable reflection plate (an elastic acryl plate coated with mercury, 3 x 6) with a high reflection rate and by moving it by hand to the rhythm. To increase reproducibility, a motor-powered automatic variety has been developed recently.

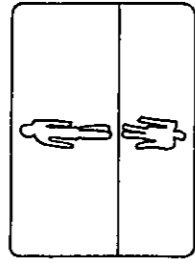
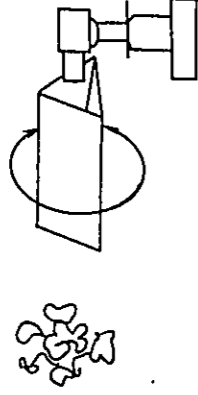
3) Aluminum foil tapes (10 cm. wide and 500 cm. long) are suspended and moved by the wind, and colors are changed to the rhythm to produce an effect.

Thus, there are almost countless techniques, but the most effective method well matching the contents of a program must be carefully chosen in a background processing lighting design plan. Over-use of these techniques, which are all effective, will result in causing an eyesore. So, proper use is basic to the techniques of visualization by lighting.

Special Studio Techniques



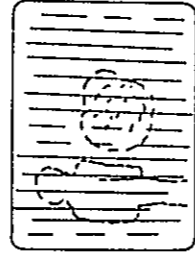
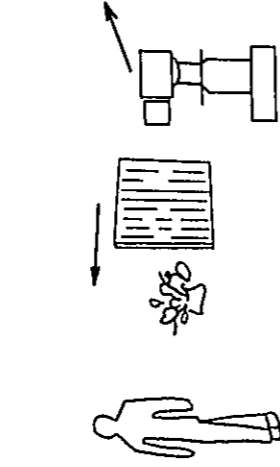
Mirror or reflector-black polyvinyl chloride plate, for example



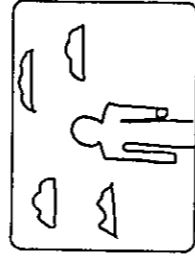
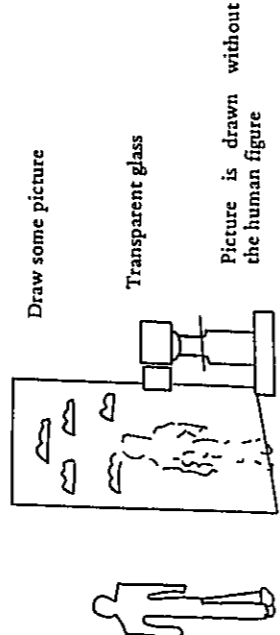
* Mirror shot



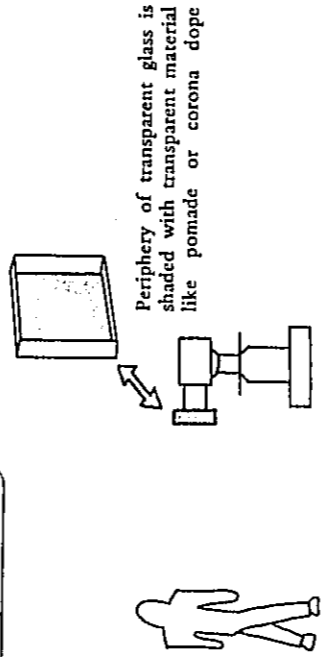
* Kaleidoscope



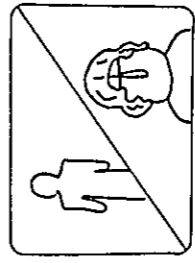
* Glass wiper



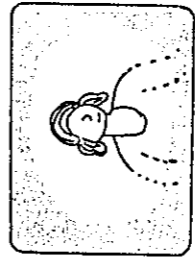
* Glasswork



Chroma-key



* Wipe effect with deformed chroma-key
Interesting effect appears by 200 ming-in

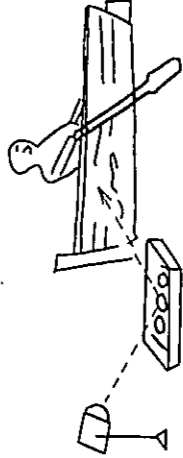


* Soft focusing glass
Soft focusing glass



* Drum set
Effective for mario-
nette, etc.

* Effect of reflection from the surface of water



Put a piece of broken mirror in a shallow container, put water in and stir with hand

4. Animation Techniques

Animation is one of the film or TV techniques that makes non-moving objects appear as if they are moving by the application of special camera work. Such animation films are used widely at NHK for educational and news programs and for public relations announcements. It is frequently used in programs intended for preschool children as one of the most suitable presentation techniques for developing their imaginations.

Objects that do not move are varied little by little. These objects are shot in frames. When the pictures are projected in rapid sequence, they appear to be moving because of the illusion created by after-images. Animation is a technique that makes use of illusion.

At NHK special equipment are used in the studio used exclusively for shooting animations, which is known as the special camera work room. In this pamphlet animation shooting using a camera capable of frame-by-frame shooting and simple material will be introduced.

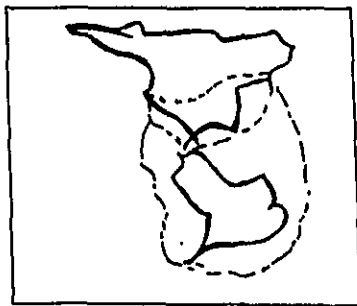
Points to be Noted in Producing Practice Materials

a. Brushing In - Maps and Graphs Line Stretching

- o The line-stretching brush-in method is a most simple animation technique. It permits forward photographing. However, it does have a drawback in that the lines are some that awkward at their joints, and the shades of the colors have an unevenness.
How to produce animation with line-stretching (the forward method).
 1. Draw in advance the picture as it is to be completed (original picture).
 2. Erase the completed picture. Draw lines on the lines of the completed picture. The lines drawn should be so thinly that they can barely be seen with the naked eye.
 3. Make the frames by tracing these lines. It is recommended to use fast-drying colors in order to reduce the photographing time.
 4. The number of frames and length of lines are calculated in advance on the basis of 24 frames per second.
Nevertheless, do not decide the tempo mechanically for the sake of uniformity. Give a touch of rhythm to the animation and make it a pleasant one, also from the visual standpoint. Slow down at the curves. Slow down when the curve upward, but make it fast when the curve is downward.
 5. There is another method, that of drawing lines on cellulose sheets which are placed above the base pictures.
- o Reverse Photographing (Erasing)
One advantage with this method is that it is easy to accomplish layouts inside the frames. There is nothing unnatural about uneven color shade or awkward line joints which are seen with forward photographing.

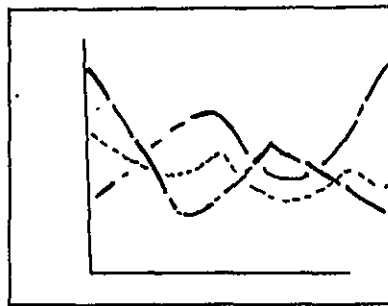
- o Reverse Photography Production Method
 1. Make sure to use a time sheet and make correct calculations. Start after remembering well the procedure when photographing in the forward direction, so that no mistakes are committed when producing the animation work.
 2. There are methods for erasure using cellulose and for cutting thin lines which are stuck on the cellulose sheets.
- o Planes can be colored in multicolors when brushing in, aside from drawing lines.

(A) Map



Moving the line

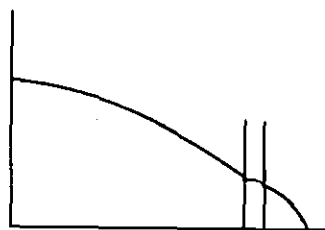
(B) Graphs



Double image of line

b. Cutting in by Means of Jigsaw

- o Photographing Method
 1. Draw a layout inside one frame and check that the overall balance is well maintained.
 2. When the layout is obtained, calculate what speed is to be used in making the animation. (the number of frames)



(seconds)

3. Fix in place the pieces which are cut.
When the pieces move even a little, they cause flickering. Fix the pieces by using adhesive tape on their backs, or by other means.

- o About Reverse Photographing

The advantages of this method are that the balance of the entire pictures can be seen easily, that it is easy to operate as all that is required is to pick up the pieces, and that there is a stability in the overall movement. The points to be noted for this method are that the tempo of it is given in reverse compared with forward photographing. For this reason, the image for the tempo should be clarified in advance.

- c. A River, a Train and Smoke

- o These are the most common examples of plane animation.

- o Photographing Method

1. Moving the Train

A method to move the train itself.

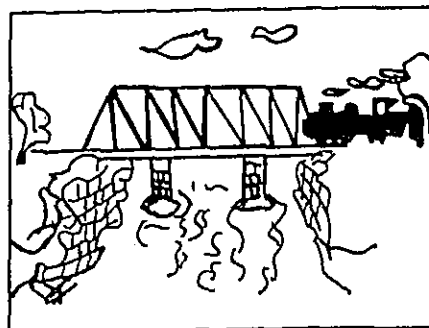
A method to draw a train on a long sheet of cellulose and move the cellulose sheet. Smooth movements can be obtained from this method.

2. Drawing Water Flowing

It is called a 'cyclic' animation method. The sizes of the waves change as the waves move from a distant point to a place nearby. It is important to watch how the waves vary.

3. Overlapping the Cellulose Sheets

Not more than three sheets of cellulose should be over-lapped. Even if there are not pictures drawn, insert the usual number of transparent cellulose sheets (on which no pictures are drawn). Do not increase or decrease the number of cellulose sheets for each scene.

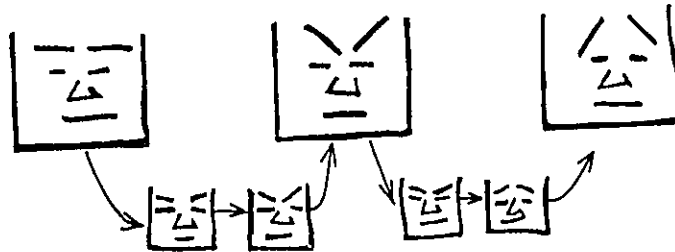


4. Animation works utilizing multilayer cellulose give the pictures a solid feeling, a large effect. On the other hand, however, they make the lighting effects, camera setting and other preparation works complex.
- d. **Clock Animation**
 - o From the movements of the second hand and minute hand, automated work and exaggerated work in the world of animation can be observed well.
 - o When making an advance for filling an interval of one second with 24 frames, there is a large difference among the following different steps in the smoothness of the movement although all of them rest in the same position exactly one second afterwards:
 - Photograph 24 frames in one action
 - Photograph 12 frames twice in one action
 - Photograph 6 frames four times in one action
 - Photograph 2 frames twelve times in one action
 - e. **Movement of Character**
 - o A character appears after the cut in.
The effect of typewriting.
 - o Movements at Frame In and Frame Out
The effects of movement, movement of the characters in each frame.
 - o Points to be Noted When Moving the Characters
Consider in advance the character layout.
 - o Draw lines which are so thin that the naked eye can barely see them so that the characters are aligned horizontally in good order and are not loose. Finally, make sure that the characters appear on the lines, when the picture is completed.
 - o The faster the characters move the less possibility there is of errors becoming conspicuous.
This principle applies to all aspects of animation production.
 - f. **Variation in Facial Expressions**
 - o Draw the original picture (which is a complete picture) in advance whether you are making an animation work by cutting paper or using cellulose sheets.
 - o Draw the momentary expressions which have been decided upon, such as a self-composed face, smiling face, angry face, etc.
Then draw expressions at the mid point as the expressions move after making a calculation for each of them. It is better to draw expressions in a somewhat exag-

gerated way which human beings cannot make.

- o Draw the outline of the sections of the face which do not move as a base picture. Draw the sections of the face whose movement does change (such as eyes, nose, mouth and eyebrows) on another cellulose sheet. The sheets are overlapped and then moved. This method is called the limited animation method.
- o The full animation method is to draw entire pictures one by one for each action. Needless to say, it is important to draw the non-moving parts in such way that they perfectly overlap when the cellulose sheets are overlaid.

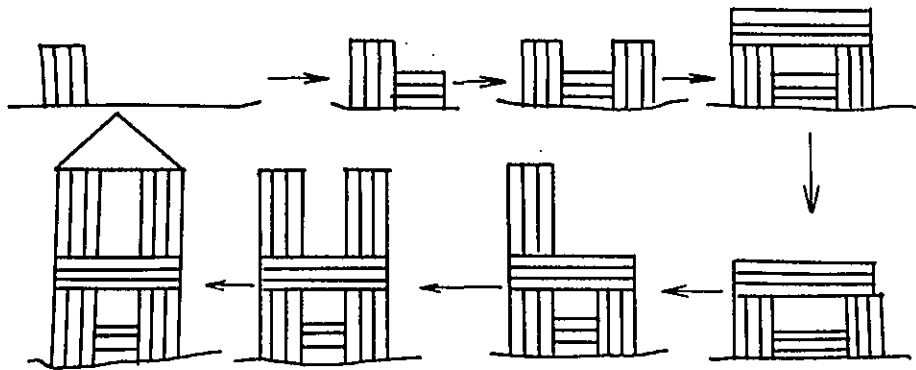
Looks Change



g. Building Blocks (Solid Animation (1))

- o In solid animation, the camera angle and lighting effects are important.
- o Fix the set. Calculate the entire course in advance. Rehearse the camera to become familiar with the operational procedure.
- o It is extremely difficult to position back dolls or building blocks precisely in the original positions once they are moved accidentally. For this reason, move them with utmost care.
- o Photographing Building Blocks
 1. First set up the blocks.
 2. Sketch them when they are set up.
 3. Design the production course.
 4. Calculate the frame counts.
 5. Draw in the time sheet.
 6. Fix the placed blocks.

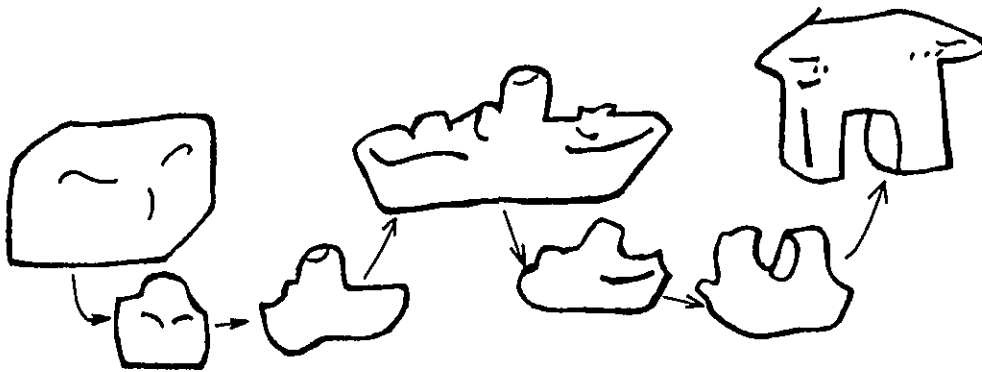
Blocks



h. Clay (Solid Animation (2))

- o The characteristic of this material is that it can be deformed freely. It is convenient

Clay change



to make a dummy (stand-in) in advance and use it in the animation production by changing its form.

- o Points to be noted:
 1. It does not return to the original form once it is deformed.
 2. It will, however, deform naturally when it is left for a long time.

5. Production of Miniprograms

Miniprograms offer an opportunity to the participants to learn production techniques for educational programs which last for about 5 - 10 minutes duration.

This practice of producing miniprograms is somewhat different from the programs which participants are usually producing in your country or region. You will have an opportunity of confirming image techniques which you have learned in this training center by cooperating on a group basis. Various forms can be considered for miniprograms. However, because of the limitations imposed on materials to be prepared and of the production time allotted, you are requested to produce by roughly dividing subjects into the following four areas:

There are the following four groups.

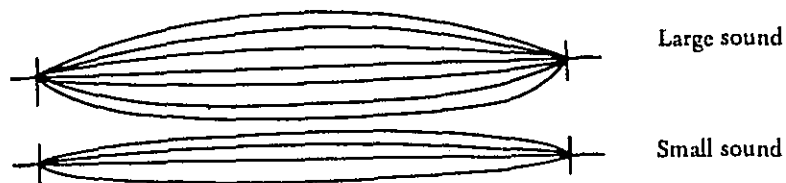
Now, each of the groups will have PD, FD, TV instructor and other roles played by the participants themselves.

- o Group # 1 To analyze how sound comes into being by using musical instruments. (Sound resonance and vibration)
(science)
- o Group # 2 To express mathematics materials with animation. (Set operations)
(Mathematics)
- o Group # 3 To produce a literary or moral program by utilizing material containing a story. (Folk-tale of old Japan)
(Literature) Urashima Taro
- o Group # 4 An English program to teach easily language construction.
(Foreign language) (To learn the comparative degree.)

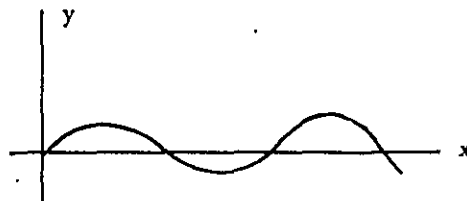
Group # 1 To analyze how sound comes into being by using musical instruments.
(Theme) Sound resonance and vibration
(Objects) 5th grade, elementary school. (10 years of age)
(Examples of test materials and image expressions)

- (1) Sound cannot be seen by human eyes, and the requirement is to teach that sound is formed by vibrations of air.
- (2) Ripples can be produced when a triangle is hit strongly or moderately and placing it on the surface of water.
- (3) Observe vibration by attaching a needle at the tip of a tuning fork, or examine it with oscillograph.

- (4) Observe sound vibrations with a monocord or by making a thread telephone.



- (5) Show that wavelength by means of a diagram, or by animation.



- (6) Synthesize the relations between an enlarged diagram of the section to be tested and the entire image by chroma-key.
- (7) Show the Japanese musical instrument "koto" being played and the vibrations of the koto strings. Consider it from the principle of sound.
- (8) Making interesting title animation on film by name of sound resonance and vibration.

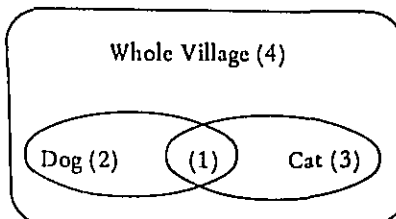
Group # 2	To express mathematics materials with animation.
(Theme)	Set operations
(Objects)	Illustrate how more than two things occurring at the same time are sorted and consider while sorting them and pigeonholing them.
(Examples of questions and image expressions)	5th grade, elementary school. (10 years of age)

Question 1

- o A survey was conducted in a village as to whether a dog or cat was kept. The

results are sorted as follows.

Dog Cat	Kept	Not Kept
Kept	1	3
Not kept	2	4



- Companies grouped together by a certain rule are called a set and are shown by writing factors in $\{ \quad \}$
- When set B is included in set A, it is written $B \subset A$.

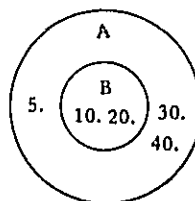
Question 2

- Please show the following pair of two sets with a diagram

A [5, 10, 20, 30, 40]

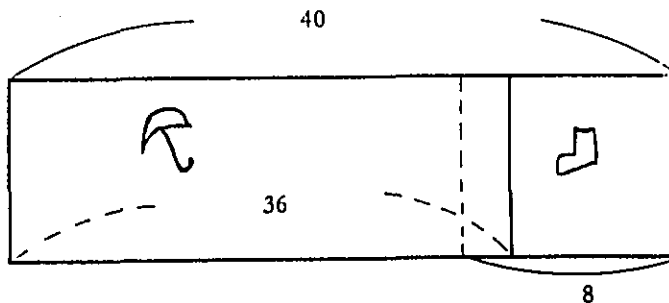
B [10, 20]

(A) (1) (Answer) B (A



Question 3

- In a class of 40 students, there were 36 students who brought an umbrella on a rainy day, while 8 students brought a rain boots. All the students brought either an umbrella or a rain boots. How many students brought both?



Those who brought only a boots were:

$$40 \text{ Students} - 36 = 4$$

Those who brought an umbrella among those who brought a boots were:

$$8 \text{ Students} - 4 = 4$$

Answer: 4 students

Question 4

- o It costs ¥ 220 to buy 4 apples and 6 mandarin oranges. It costs ¥ 160 to buy 4 apples and 3 mandarin oranges of the same size and quality. How much does an apple cost? How much does a mandarin orange cost?

¥ 220 ...

¥ 160 ...

¥ 60

Answer: An apple costs ¥ 25
A mandarin orange costs ¥ 20

NOTE: Let us merrily teach the foregoing classification calculations by using sliding captions or diagrams. It is a good idea to change animals or fruit in the material in different ways.

Group # 3 To produce a literary or moral program by utilizing material containing a story.

(Theme) Folk tale of old Japan, "Urashima Taro"

(Objects) 1st - 2nd grades, elementary school. (6 - 7 years of age)

(Examples of test materials and image expressions)

- (1) Visually present the story introductory section with a sentence, using a roll pattern as introduction.
- (2) Illustrate the scene of a turtle being teased by children by using handicraft animation to further progress the story and to emphasize a moral element.

- (3) Use a water tank and the chroma-key technique to illustrate the scene of Urashima Taro going to the Palace of the Dragon King on the back of the turtle.
- (4) Express the dream-like days for Urashima Taro being entertained by the Princess at the Dragon King's Palace by using images incorporating roller-graphic.
- (5) Express the scene of Urashima Taro bidding farewell to the Dragon King's Palace and returning to his beach by combining both sliding patterns and electrical montage.
- (6) Express the scene of Urashima Taro opening Pandora's box and suddenly becoming an old man being engulfed in white smoke emitting from the box by using film animation.

Reference: The tale of "Urashima Taro" to serve as the basis for the production of this program is as follows.

(Data for Group # 3)

"Urashima Taro" - Folk tale of Old Japan -

- *1 Once upon a time there lived young man by the name of Urashima Taro.
- *2 One day, Urashima Taro saw children teasing a turtle on the beach when he arrived there to go fishing. Taro thought that was cruel and bought the turtle from the children, setting the turtle free in the sea.
- *3 A few days later, Urashima Taro heard a knock on his boat as he was fishing in the sea. He saw the turtle he had saved, and the turtle offered him to take him to the Palace of the Dragon King in return for his kind act. Taro gladly accepted the turtle's offer and proceeded to the Palace sitting on the turtle's back.
- *4 Taro was greeted by the princess and fish when he arrived at the Palace. He was taken to the hall where seabreams and soles danced for him. He was entertained well with food and dancing and forgot about passing years.
- *5 Becoming tired of the fun, Urashima Taro suddenly determined to go back to his country. After hastily bidding farewell to the Princess, Taro returned to his beach sitting on the back of the same turtle holding under his arm Pandora's box which the Princess had given him as a souvenir.
- *6 Returning to his country, he could hardly recognize anything. The house he had lived in and the village in which he had grown up were completely changed. The people on the streets were strangers for him. Feeling forlorn, Taro opened the box he had received from the Princess as a souvenir. The box emitted white smoke and Taro was instantaneously transformed into an old man with a white beard.

~~~~~  
 Group # 4 . . . . . A foreign-language program to teach the construction and nature of a foreign language for easy understanding.

(Theme)

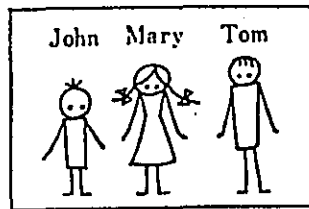
**Learning the comparative degree**

(Objects)

Students in their first year of learning a foreign language (English).

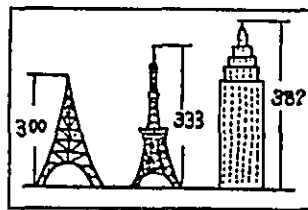
(Examples of materials and expressions)

**COMPARISON**

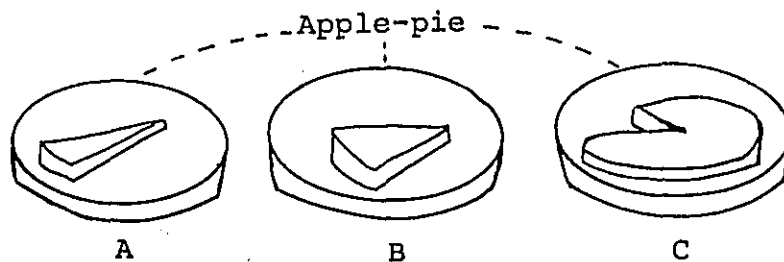


\* TV Instructor Orientation

1. Mary is taller than John.  
Tom is taller than Mary.  
Tom is the tallest of the three.  
(semi-silhouette expression or cartoon)



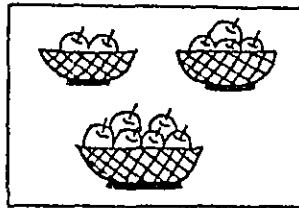
2. The Eiffel Tower is 300 meters high.  
The Tokyo Tower is 333 meters high.  
The Empire State Building is 382 meters high.  
The Tokyo Tower is 33 meters higher than the Eiffel Tower  
The Empire State Building is 49 meters higher than the Tokyo Tower.  
(semi-silhouette expression and super-imposed captions)



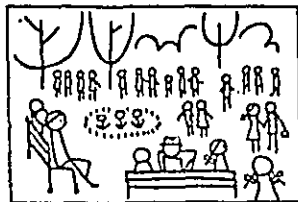


3. C has more apple-pie on C than on B.  
 C has more apple-pie on C than on A.  
 B has less apple-pie on B than on C.  
 A has less apple-pie on A than on C.  
 (chroma-key expression and super imposed captions)

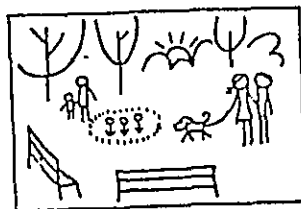
\* To use animation or silhouette



There are many people in the park on Sunday.



In the morning, there are few people in the park.



Animation film production on to change liquid by means of English explanation.



There is much water (juice) isn't much water (juice)

There is little water (juice) in my cup.

\*NOTE: Give a change by moving the pictures, sliding and pulling out the pictures, or adding pictures to make the students understand the English phrases written above.

Above cases for "Many", "Much", "Few" and "Little". Let us think about expression with the aid of cartoons, or animated cartoons, to allow the students understand the English phrases written above.

#### Special Effects and Educational Programs

It is important to try to achieve appropriate video effects by considering carefully the basic nature of an educational program.

NHK defines an education program as having the following objectives in its "Domestic Program Broadcasting Standard".

- (1) Objects for broadcasting are clearly defined, and the contents of a program are useful and appropriate particularly to such objects.
- (2) Be systematic and coherent in order to increase educational effects.
- (3) To strive for the cause of equal educational opportunities through broadcasting.
- (4) To consider and respond to the learning level and physical development stage of infants and students.
- (5) To contribute means of improving the teachers' study guidance methods, etc.

When all the foregoing requirements are considered, it is only natural that video expression of educational programs must be most appropriate in principle after giving consideration to the purposes and objectives of such programs.

Educational programs, which tend to give an impression that they are hard and dry, can be shown agreeably and entertainingly, if they are repleted with a variety of video expression and versatility.

You will readily understand that pictures should contain variety and that they should be changed often when they are intended for infants or children, who become easily bored and whose attention is quickly distracted.

Nevertheless, the efforts spent in video expression themselves sometimes work rather negatively when the pictures become too loose when the speakers' story is desired to be heard well, or when educational contents of a high degree are desired to be transmitted to an audience of grown-ups.

The prerequisite of a producer is to understand diverse methods of image expres-

sion and to become familiar with them. It should be remembered that the most important consideration is the objectives of educational programs and their contents.

